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Preparation and Characterization of A Sandwich Structure Alternate Thiol-ene Materials

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Introduction

Thiol–ene materials have received significant attention because of the highly efficient reactions of thiols with reactive C=C bonds in allyl or acrylate systems during the last century. A new structured thiol-ene material with drastically different mechanical proportions was successfully prepared via a free radical based thiol-ene addition reaction.

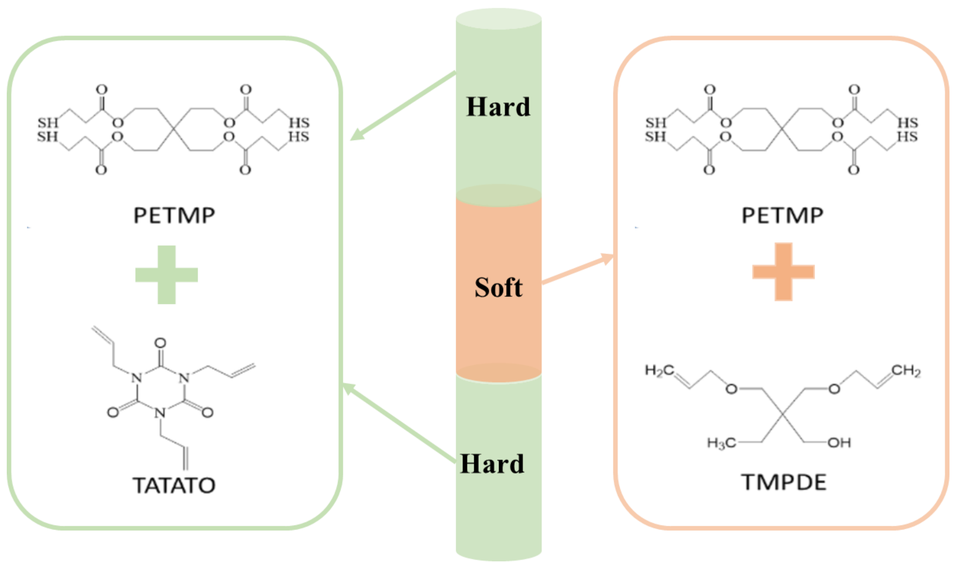

Figure 1. The different components of hard segment and soft segment

Experiment

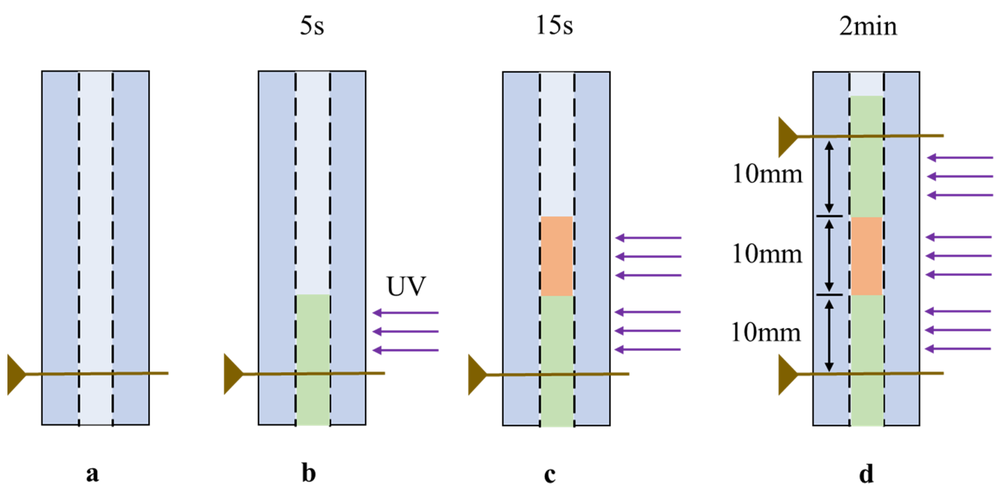

Figure 2. The production process of hard-soft alternate sample . Hard polymer liquid was slowly poured into the mold onto the side by using a 10ml syringe. After that the mold was placed in an ultraviolet light box by exposure 5seconds(Figure 4b), and then, injected the 10cm soft liquid, the second hard parts was prepared after another needle impaled the mold in the same way (Figure 4c and 4d), The mold was placed into the box under the UV-light for 2mins to complete the process.

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References

1. J. W. Chan, and A. B. Lowe, Polymer, 2009,50, 3158-3168.
2. C. E. Hoyle, A. B. Lowe , Chem. Soc. Rev.,2010, 39, 1355-1387.
3. M. J. Kade, D. J. Burke , J. Polym. Sci., Part A: Polym. Chem., 2010, 48, 743-750.
4. Q. Huang, N. J. Alvarez, A. Shabbir and O. Hassager, Phys.Rev. Lett., 2016, 117, 87801.
5. Q. Huang, M. Mangnus, N. J. Alvarez, R. Koopmans and O. Hassager, Rheol. Acta, 2016, 55, 343–350

Results

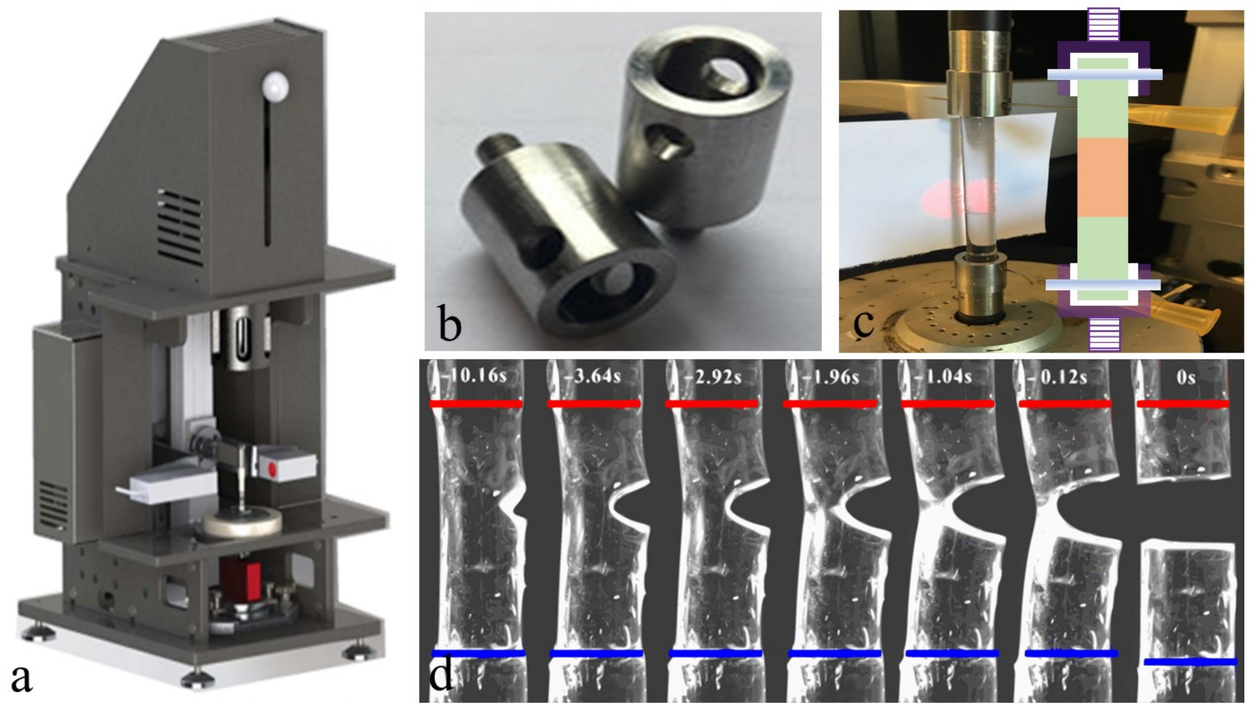

Figure 3. **a**. The rheological measurements were carried out using the filament stretching rheometer (VADER 1000 from **Rheo Filament ApS**) with a strain rate of $0.001s^{-1}$; **b**. A pair of stainless steel fixtures have been made as add-ons to the filament stretching rheometer; **c**. The real-time diameter $D_{(t)}$ is measured by a laser micrometer during stretching and the elevation view of the fixture and soft-hard alternate material. **d**. the images of fracture process was recorded by using the high-speed camera, the crack was generated in the soft segment surface not in the interface of the hard and soft material.

Discussion

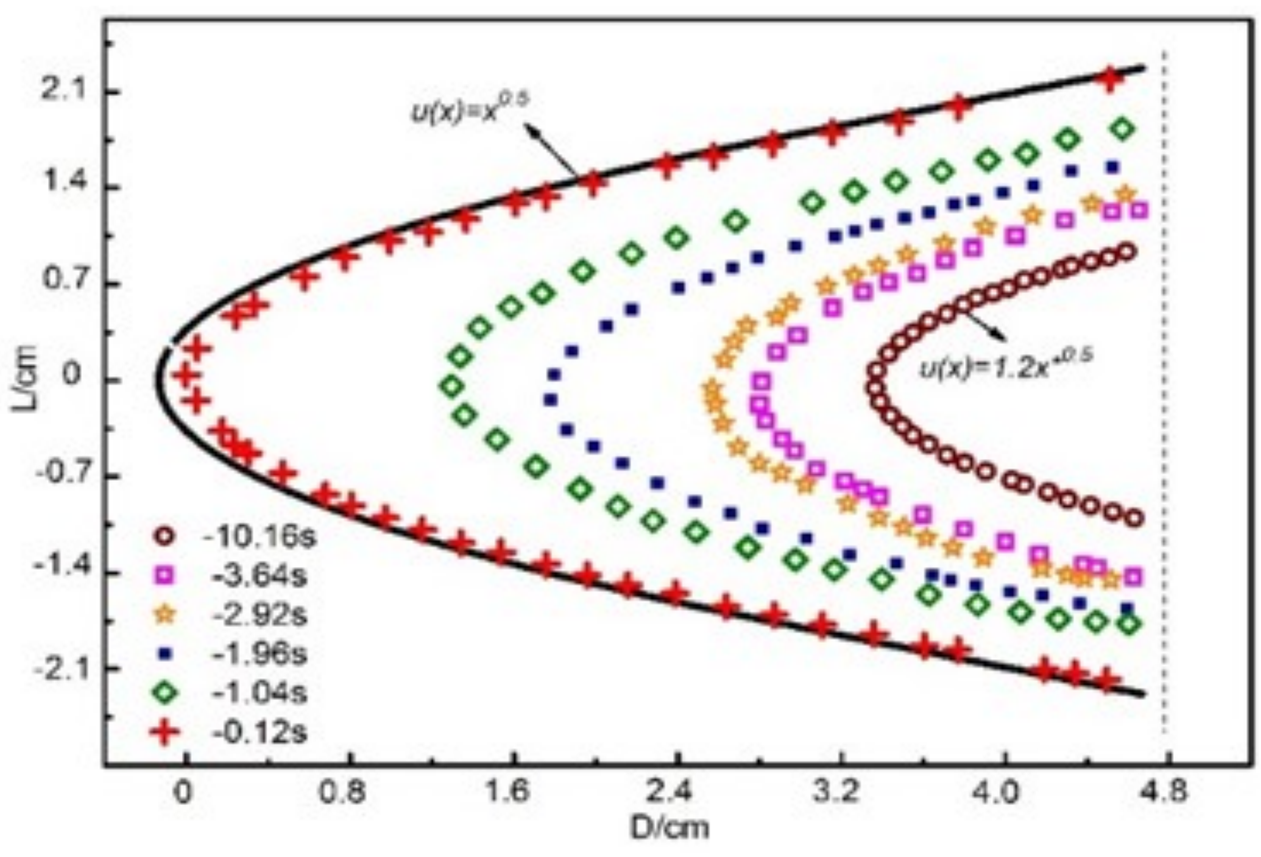

Figure 4. The fracture process could be fit using parabola.

Thiol-ene materials has widely used in our daily life, we chose two thiol-ene materials, which had very different machinal properties at room temperature, to synthesize a new sandwich structure hard-soft alternate by step by step under UV light illumination. The filament stretching rheometer and high-speed camera was used to record the stretch and fracture process. We found the fracture fit equation u(x)=x^0.5, and a useful step by step UV illumination synthesis method was designed to obtain strong enough interface alternate material, so as to provide a new perspective for multipurpose material.